THE FOSSIL COLLECTOR

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The rugose coral *Xystriphyllum mitchelli* (Etheridge Jr 1892) and *Favosites* sp. (right) exposed on weathered outcrop of Early Devonian Murrindal Limestone above old Rocky Camp Quarry, Buchan, Victoria.

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THE FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA

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Taxonomic Disclaimer

This publication is not deemed to be valid for taxonomic purposes [see article 8b in the *International Code of Zoological Nomenclature* 3rd edition 1985. Eds W. D. Ride *et al*].

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EDITORIAL NOTES

I am extremely happy to announce that on March 5, at 7:31 p.m. our third daughter, Ebonee Jayne, arrived safe and very sound. At 4.330 kg (or 9 pound 8 ounces) Ebonee was the heaviest of the three girls but is was by far the easiest birth for Julie. As with Ayla and Nakita, the birth was totally overpowering for me, with just a few tears rolling down the cheeks (haven't figured out yet whether the tears were for the new baby and what Julie just went through or the fact that I am now outnumbered four to one). Ayla and Nakita have been excellent sisters to Ebonee which has made life just that little bit easier. We though that with Nakita having a different personality to Ayla (a lot less passive than Ayla), there was going to be some jealousy and aggression but fortunately this hasn't eventuated. I hear a few people commenting on the spelling of Ebonee, well that's my fault as although Julie picked the name I wanted the spelling to be different, just to see if people were taking notice, and it worked.

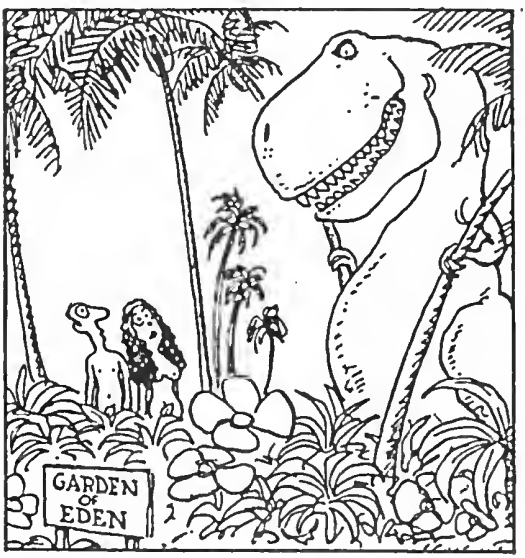
In the January issue, I mentioned that Wrotham Park Station was for all intents and purposes being shut down to those collectors, and others, who choose to enter the property without permission. Also mentioned that the Blackdown Station side of Wrotham Park was to be fenced and the access road gated and locked. At last report, the fence and locked gate have happened and regular helicopter patrols are being run down the Walsh River. I'm also a little saddened to report that since the January issue was posted out, I have received two anonymous telephone calls accusing me of being responsible for Wrotham Park being shut down and denying people the chance of making a "buck". To those people I would say that if agreeing with what the station manager is saying is telling him to shut the place down, then I am glad I agreed. If denying someone who butchers a fossil locality (either directly or indirectly by employing another to do the dirty work) the opportunity to make a dollar, then I am doubly glad I nodded my head at the right times. I will no doubt be criticised by some for the stance I am taking here but quite frankly, I am happy to take up the flag for those of us who go about amateur fossil collecting in a scientific and responsible manner. I am sure that most of us who are or have been tarred with the same brush as those who conduct themselves improperly are a little tired of this, I know I am. To those two people who phoned me, next time have the intestinal fortitude to tell me who you are or don't bother phoning.

On a far better and happier note, a new reader to *The Fossil Collector* has discovered what could be a significant Triassic insect locality. This locality is not only giving up insect wings (one of which looks very much like a butterfly/moth wing, even down to the venation and pattern markings), but a great number of

complete insects as well. One of the complete insects looks very much like a grasshopper or cricket while the others so far recovered are probably cockroaches, beetles and weevils. If the butterfly/moth wing and grasshopper/ cricket turn out to be what the discoverer and I are calling them, then I believe this may have some serious implications on what we think the world was like back in the early Mesozoic. Butterflies and moths are linked to nectar producing plants and it is accepted that flowering plants did not evolve till the Cretaceous. The question here is, if the wing is a butterfly or moth, did the fruiting bodies of Triassic plants produce nectar? This same locality has also turned up some other significant oddities which, if verified, will make this the most significant Triassic locality in Australia if not the world.

The other project I am involved in, cave deposits from Rockhampton, is still turning up a wealth of interesting material. We hope to have this material dated in the near future which will then give us a clear idea on how the area was evolving climatically and how quickly Australia's east coast rainforests were retreating. I am continuing the steep learning curve on some of the families in the Macropodoidea and although I haven't started on the nitty gritty yet, I am told that the preliminary study would indicate that the final analysis is going to be interesting.

Readers will notice that this issue's In The News section is somewhat sparse on news stories. With Frank Holmes' excellent article on the Buchan - Murrindal area I have held a great many news stories over to the September issue at which time I will clear the backlog and hopefully provide a fatter and a little more interesting In The News section.



Maintaining the controversial nature of this Editorial Notes, some may have a chuckle at the cartoon (left) which appeared in the Herald Sun back in November 1997. Sure generates some interesting thoughts, especially given the news article on *T. rex* which appears on page 27 of this issue. Haven't figured out yet whether the cartoon implies *T. rex* is 6,000 years old or Adam and Eve are in excess of 65 million years old. Interesting!!

The deadline for Bulletin 64, will be July 31 2001.

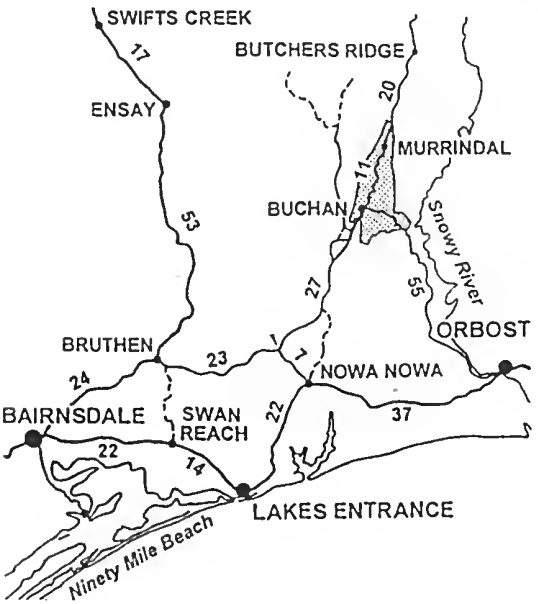
FOSSILS OF THE CAVE COUNTRY: A GUIDE TO THE BUCHAN - MURRINDAL AREA OF VICTORIA

Compiled by Frank Holmes

Situated 359 kilometres east of Melbourne in the foothills of the Victorian Alps, the small historic township of Buchan (population about 400) is known to tourists for its remarkable caves and the beauty of the surrounding countryside. Although a mecca for Victorian rock hounds for more than thirty years, few amateurs interested in other aspects of the Earth Sciences will be aware of the surprising diversity of Lower Devonian fossils to be found in the limestones that outcrop between South Buchan and north of Murrindal (Fig. 4), as well as at several small isolated exposures in the general area. These include Jacksons Crossing and The Basin, both northeast of Buchan; Butchers Ridge and Gillingal to the north and northwest of Murrindal respectively; and at "Dargans" on the Snowy River east of Buchan.

EARLY HISTORY

The Buchan area was first explored by Europeans from the Monaro District, southwest of Cooma, N.S.W. It is claimed that Edward Bayliss marked out a temporary cattle run at Buchan in October 1838 before returning to the Monaro to obtain cattle and supplies. However, it appears to have been a John Wilkinson who first occupied the Buchan run early in 1839, having set out from the Monaro just before Bayliss could return to the south. The latter had to be content with establishing a run at Gelantipy, some 30 kms north of the area where the township of Buchan, originally known as Bukan-Mungie by local aborigines, was eventually to be proclaimed in 1873 (O'Bryan 1983, Buchan Sesquicentenary Committee 1989).



Locality Map (distances in kilometres).

HISTORY OF RESEARCH

The first geological survey of

northeastern Gippsland, which included a brief description of the limestone sediments in the vicinity of Buchan, was carried out by Alfred Howitt (then a Warden of the Goldfields of Victoria) and reported in 1876, although the earliest record to the occurrence of these Devonian limestones was made by Selwyn and Ulrich in 1867. In the same year that Howitt's report was published, Frederick McCoy described in detail five fossil species from the Buchan Limestone; the coral *Favosites goldfussi* d'Orbigny 1850, the brachiopods *Spirifer laevicosta* (= *Spinella buchanensis* Talent 1956) and *Chonetes australis* [now *Protochonetes*], the nautiloid *Phragmoceras subtrigonum* (now *Pectinoceras*), and the fish *Asterolepis ornatus* var. *australis* [= *Buchanosteus confertituberculatus* (Chapman 1916)].

BUCHAN.

Lithograph of sketch by Alfred Howitt—Geol. Surv. Vict., Rep. Prog. III, 1876.

While Howitt had noted the occurrence of limestone caves in the Buchan area, it was James Stirling who carried out the first systematic exploration of the then known major caves. His detailed report was published in 1889, by which time reservations had been created at Spring Creek, Wilson's Cave and Dickson's Cave. During his explorations Stirling collected many vertebrate fossil remains from and below the floors of various caves. McCoy made notes on these remains in an appendix to Stirling's report.

In the following years, R. A. F. Murray (1895), W. H. Ferguson (1898) and 0. A. L. Whitelaw (1899) each summarised and added to the existing knowledge of the geology of the Buchan district. However, it was left to Frederick Chapman to describe the fossils in a series of palaeontological papers, the first two of which appeared in 1905, and in his book "Australasian Fossils" (1914). By 1922, in a study of the Devonian of Australia, W. N. Benson was able to list 21 species of fossils from the Buchan limestones.

During the next 30 or so years, publications relating to the Buchan area were almost entirely restricted to the taxonomy of particular groups of fossils, namely the stromatoporoids (Ripper 1937); goniatites (Teichert 1948); corals (Hill 1950); nautiloids (Teichert & Glenister 1952); ostracodes (Kroemmelbein 1954); and brachiopods & pelecypods (Talent 1956).

In 1958, Teichert & Talent published the most comprehensive survey yet produced of the "Geology of the Buchan area, East Gippsland". This Geological Survey of Victoria Memoir (No. 21) contains a complete survey of the individual faunas to be found in the Buchan Group, listing over 180 species. It is followed by a very detailed account of the geology of the various limestone formations and members; the geomorphology, in particular the extensive cave systems; and a review of the economic geology of the area.

In more recent years many of the published papers which provide information on the fossil faunas, geology and biostratigraphy of the Buchan Group do not specifically relate to this area of East Gippsland, but rather to the Devonian of southern Australia as a whole, or in some cases simply to specific taxonomic groups, for example the papers on the evolution of the oldest ammonites (Erben 1964, 1965). For this reason it is often time consuming to trace the currently accepted binomen (generic and specific name) of a fossil referred to in an earlier manuscript. Papers covering the following subjects published since 1958 are of particular significance: geology of the Murrindal River - Yalmy River area (Bradley 1969); correlation of Lower Devonian rocks (Strusz *et al.*1972); conodonts and conodont/ammonite biostratigraphy (Mawson 1987, Mawson *et al.* 1992);

pelecypods (Johnston 1993); stromatoporoids (Webby *et al.* 1993); foraminifera (Bell 1996); and styginid trilobites (Holloway 1996). In addition several papers by Hill, Jell and Pedder written during the late 1960s update much of the Devonian coral taxonomy.

GEOLOGICAL OVERVIEW

The Early Devonian (late Pragian to late Emsian) Buchan Group, which comprises the Buchan Caves Limestone, the Taravale Formation and the Murrindal Limestone, is a sequence of carbonate and calcareous mudstone which once extended over the entire Buchan Rift (a broad extensional basin which generally coincides with the outcrop margins of the Snowy River Volcanics). The largest and most complete remnant of this Early Devonian depositional sequence is the Murrindal Synclinorium that extends from about 8 km south of Buchan to about 4 km north of Murrindal. Of the other remnants, only two, those at Bindi (about 73 km northeast of Buchan) and at The Basin, encompass more than the Buchan Caves Limestone.

The **Buchan Caves limestone,** the lowest unit of the Buchan Group, rests disconformably, or with minor unconformity on the Snowy River Volcanics and reaches a maximum thickness of about 230 m at East Buchan. In many places there is a thin discontinuous transitional sequence between the Snowy River Volcanics and the Buchan Caves Limestone, known as the **Spring Creek Member,** which includes a great variety of clastic sediments, cherts and carbonates (VandenBerg 1988). The basal sequence of the Buchan Caves Limestone, which is generally unfossiliferous, consists of dolomites and dolomitic limestones up to 40 m thick. This is overlain predominantly by calcarenites with a fairly high frequency of oncolites, rare crinoidal limestones and, in the upper parts of the formation, calcilutites. Corals, ostracodes, brachiopods and bivalve faunas are notable for their relatively low diversity, although more diverse faunas occur in the upper third of the formation.

The **Taravale Formation,** which conformably overlies the Buchan Caves Limestone, consists of a sequence of nodular limestones, shales and impure limestones that reach a thickness of about 700 m in the Buchan-Murrindal area. It is characterised by pelagic faunas, in particular dacryoconarids, ammonoids (rare) and conodonts (Mawson *et al.* 1992). The lower part of the formation contains a diverse brachiopod fauna.

In part, the Taravale Formation grades northwards into the **Murrindal Limestone,** a unit up to 230 m thick that embraces a rich array of carbonate lithologies from micrites to calcarenites with minor rudites, algal limestones and

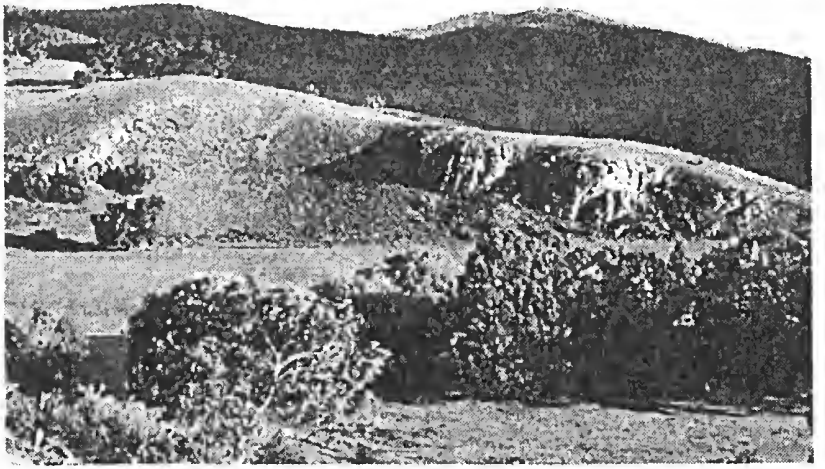


Figure 1. East Buchan thrust fault (Buchan Caves Limestone) south of the Buchan River near Wilson Cave. Mt Tara in the background.

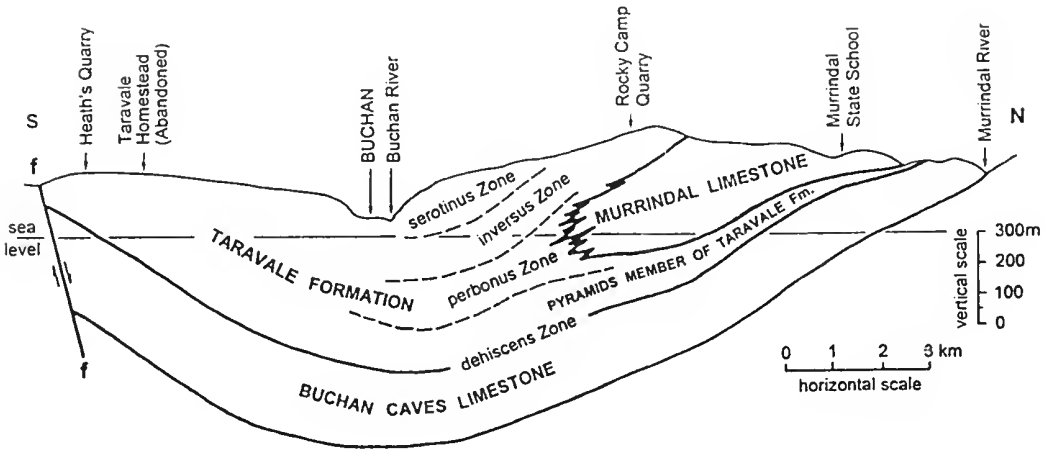


Figure 2. Diagrammatic north-south section of the Buchan-Murrindal area showing the relationship of Buchan Group stratigraphic units (modified from Mawson 1987).

intercalations of mudstones, calcareous mudstones and nodular limestones (Mawson 1987). Teichert (in Teichert & Talent 1958) divided the unit into two members; the **McLarty Member** consisting of well bedded limestones, and the **Rocky Camp Member** consisting of massive limestones. This subdivision has been queried by Philip (1966) and later authors. The Murrindal Limestone contains a rich fossil fauna including rugose and tabulate corals, stromatoporoids, receptaculitids, dacryoconarids, conodonts, trilobites, ostracodes, brachiopods, gastropods, nautiloids, bivalves, abundant crinoid columnals and rare placoderm remains (Holloway 1996).

A tongue of the Taravale Formation, which lies between the Murrindal Limestone and the Buchan Caves Limestone, is known as the **Pyramids Member** of the Taravale Formation. Apart from exposures in road cuttings there are few outcrops [Note: the limestone outcrop known as 'The Pyramids' or 'Citadel Rocks' is part of the Buchan Caves Limestone and not the Pyramids Member of the Taravale Formation].

LOWER DEVONIAN PALAEONTOLOGY

As previously mentioned, only one major work has dealt with the Lower Devonian faunas of the Buchan area as a single entity, that of Teichert and Talent (1958). Since that memoir was written, much Australian Middle Palaeozoic taxonomy has been revised, particularly in relation to the generic assignment of species. In addition, recognition of numerous synonyms has resulted in a reduction in the number of accepted taxa.

The following review of the fossil faunas is not necessarily complete or the references listed exhaustive. It is however, as far as is possible, an up to date guide to the wide range of faunas found in the limestones and mudstones of the area and their taxonomic elements. For the sake of brevity, specific names have generally been omitted. Further information can be obtained by checking the references listed at the end of this article.

Stromatoporoids

Stromatoporoids (not to be confused with stromatolites) are an extinct group with doubtful affinities that produce large, coral-like calcareous skeletons that are an important element of Middle Palaeozoic rocks. The reef facies that occur in the upper beds of the Buchan Caves Limestone, at localities such as Heath's Quarry, and in the Murrindal Limestone to the west of the old Murrindal School and at Rocky Camp, contain one of the most diverse Early Devonian stromatoporoid faunas in Victoria.

First described by Ripper (1937) they have recently been revised by Webby *et al.* (1993) who list 18 species in 13 genera. Of the latter, *Syringostromella* and *Coenostroma* appear to be restricted to the Buchan Caves Limestone and *Strictostroma*, *Parallelopora* and *Habrostroma* to the Murrindal Limestone. *Actinostroma*, *Gerronostroma*, *Petridiostroma*, *Clathrodictyon*?, *Atelodictyon*, *Pseudotrupetostroma*, *Stromatopora* and *Atopostroma* are common to both formations.

Foraminiferans

It is only in the last ten or so years that any detailed work on Victorian Devonian foraminiferans has been carried out; Bell (1996) describing 26 genera and forty five species of agglutinated foraminiferans from the Buchan Caves Limestone and the Taravale Formation. These include 2 new genera and 24 new species from the Buchan-Murrindal area. As most of the species described are regarded as new, and as far as is presently known represent an assemblage that is endemic, they cannot in themselves serve as an aid to stratigraphic correlation (Bell 1996).

Bivalves

Bivalves (pelecypods) are a rather subordinate element in the Buchan Caves Limestone and except for a few very rare occurrences are restricted to the upper part of the formation (Talent 1956). However they are diverse, being represented by Solemyidae sp. and the genera *Cornellites*, *Actinopterella*, *Nuculana*, *Aviculopinna*, *Eoschizodus*, *Paneka*, *Mytilarca*, *Actinopteria*, *Glyptodesma*, *Phorinoplax*, *Goniophora*, *Guerangeria*, *Sanguinolites*?, *Schizodus* and *Paracyclas*, (Talent 1956, Johnston 1993). A small genus, possibly *Paracardium*, is a rare occurrence in the Murrindal Limestone (Teichert & Talent 1958).

Rostroconchs
The rostroconch *Conocardium howitti* is fairly widely distributed through the Buchan Caves Limestone (Talent 1956).

Algae (see also Receptaculitids)
Algae play a very minor role in the building of limestones in the Buchan Group. However, **oncolites** (originally referred to as algal pisolites) occur at many horizons in the Buchan Caves Limestone (Talent 1956. Teichert & Talent 1958). Individual oncolites (nodular stromatolites composed of irregular laminations formed around a nucleus - at Buchan usually small gastropods) range up to 10 mm in diameter (Fig. 3D).

Corals

Corals are primarily found in the bedded or massive limestones although they do occur throughout the Buchan Group. While McCoy (1876), Chapman (1912) and Hill (1940) refer to corals from the Buchan area, the full extent of the fauna was not recorded until Hill (1950) described a total of 28 species.

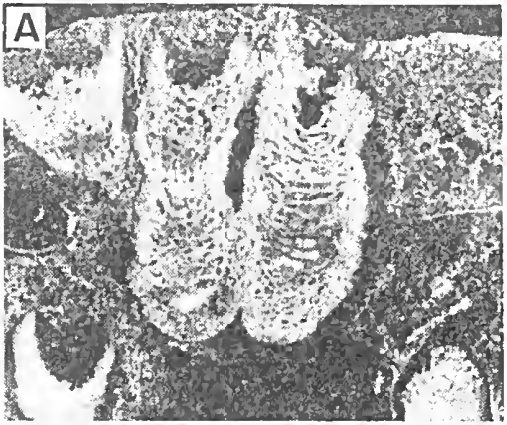
Currently 25 species in 16 genera are recognised from the Buchan Group. These are almost evenly divided between the **Tabulata** and the **Rugosa;** the former being represented by 13 species in 8 genera - *Squameofavosites*, *Favosites*, *Roemeripora*, *Thamnopora* (Fig. 3C), *Alveolites*, *Aulopora*, *Syringopora* (Fig. 3B) and *Cladopora*; and the latter by 12 species in 8 genera - *Xystriphyllum* (front cover), *Chalcidophyllum*, *Disphyllum*, *Embolophyllum*, *Metriophyllum*, *Fasciphyllum*, *Haptophyllum* and *Taralasma* (Pickett pers. comm.).

Although corals are common in the upper beds of the Buchan Caves Limestone, where they are characterised by *Chalcidophyllum recessum* (Hill 1940) - Fig. 3A, it is the Murrindal Limestone that contains the most diverse fauna of the Group, 16 species (10 tabulata & 6 rugosa) of which only three, *Favosites bryani* Jones 1937, *Thamnopora alterivalis* (Chapman 1912) and *Aulopora* cf. *conglomerata* Goldfuss 1829 are common to both formations. Corals are also present in the Taravale Formation but are nowhere near as prolific.

Gastropods

These are also rare in the Buchan Group and generally so poorly preserved that they are almost impossible to identify or describe, consequently no systematic description of the fauna has so far been attempted. However, Teichert and Talent (1958) list six genera - *Loxonema*, *Baylea*, *Mourlonia*, *Bellerophon*, and large pleurotomarids, either *Trochonema* or *Worthenia.* A species of *Loxonema* (Fig. 3E) found in the upper half of the Buchan Caves Limestone and in the Taravale Formation, is the most common.

Figure 3, Page 13. A, rugose coral *Chalcidophyllum recessum* (Hill 1940) x 1.5; B, tabulate coral *Syringopora flaccida* Hill 1950 x 0.75, Murrindal River near The Pyramids; C, tabulate coral *Thamnopora alterivalis* (Chapman 1912) x 1.5, The Pyramids; D, algal oncoliths with gastropod nucleus x 1.5, The Pyramids; E, gastropod *Loxonema* sp. x 0.6, in massive black limestone, north of old Murrindal School; F, black and white 'marble' with nautiloid (bottom right) x 0.75, Old Gelantipy Road. All specimens from the Buchan Caves Limestone.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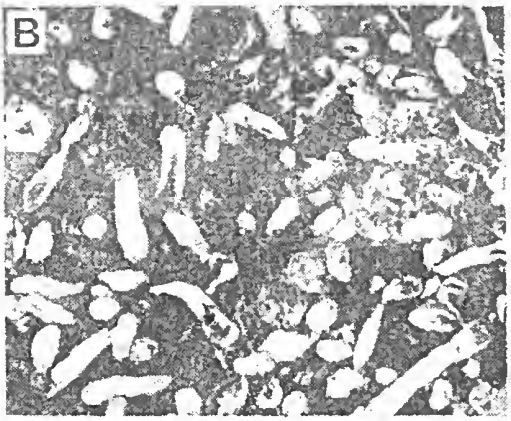
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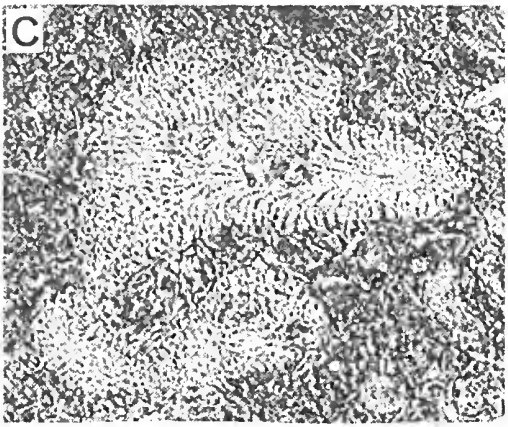
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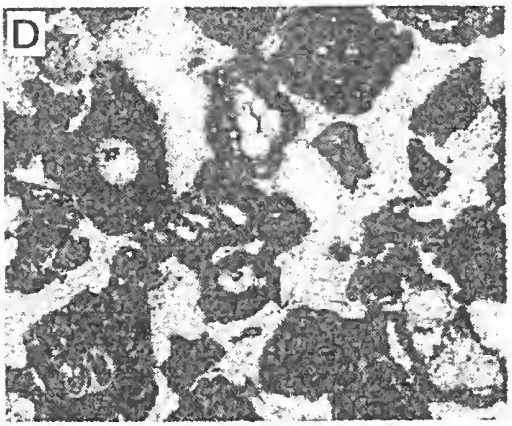
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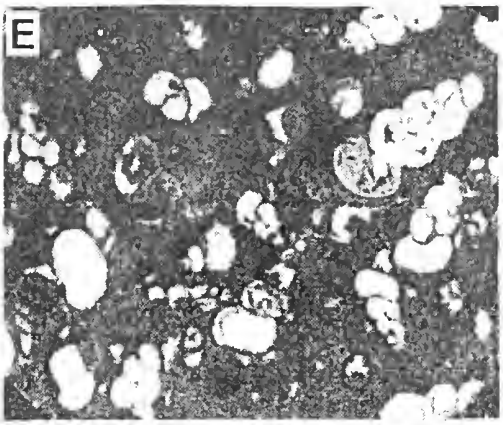
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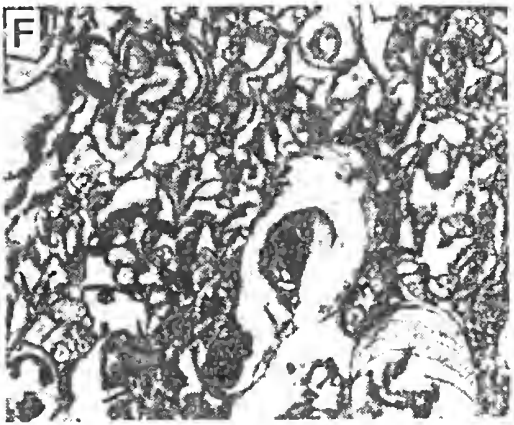
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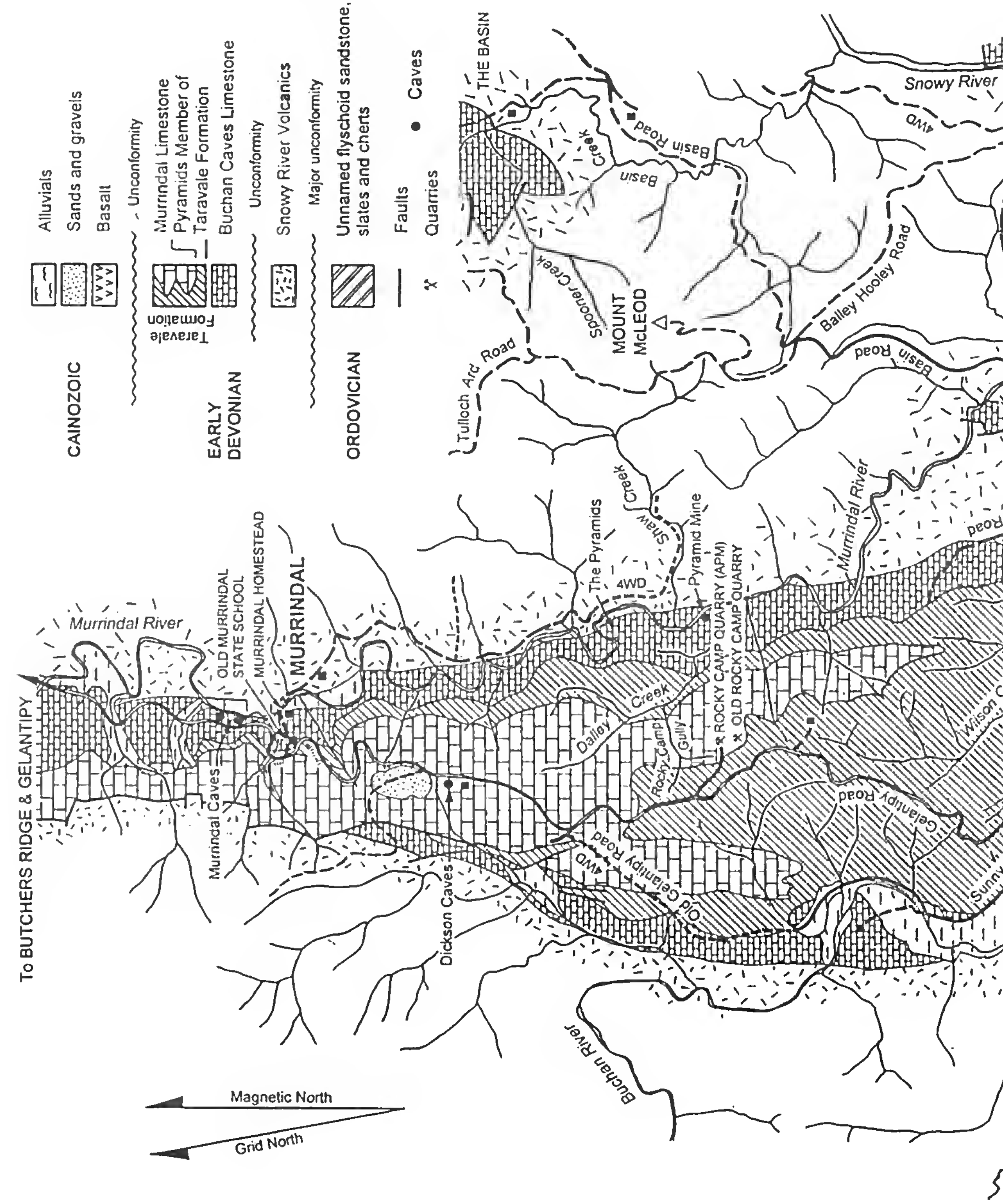
CAINOZOIC
Alluvials
Sands and gravels
Basalt
Unconformity
EARLY DEVONIAN
Taravale Formation
Murrindal Limestone
Pyramids Member of Taravale Formation
Buchan Caves Limestone
Unconformity
Snowy River Volcanics
Major unconformity
ORDOVICIAN
Unnamed flyschoid sandstone, slates and cherts
Faults
Quarries
Caves
THE BASIN
Snowy River
4WD
Basin Road
Basin Creek
Balley Hooley Road
Spooner Creek
MOUNT McLEOD
Tulloch Ard Road
Shaw Creek
The Pyramids
4WD
Pyramid Mine
Murrindal River
Road
ROCKY CAMP QUARRY (APM)
OLD ROCKY CAMP QUARRY
OLD MURRINDAL STATE SCHOOL
MURRINDAL HOMESTEAD
MURRINDAL
Murrindal River
Dalley Creek
Rocky Camp Gully
Wilson
Gelantipy Road
Old Gelantipy Road
4WD
Sunny
To BUTCHERS RIDGE & GELANTIPY
Murrindal Caves
Dickson Caves
Buchan River
Magnetic North
Grid North

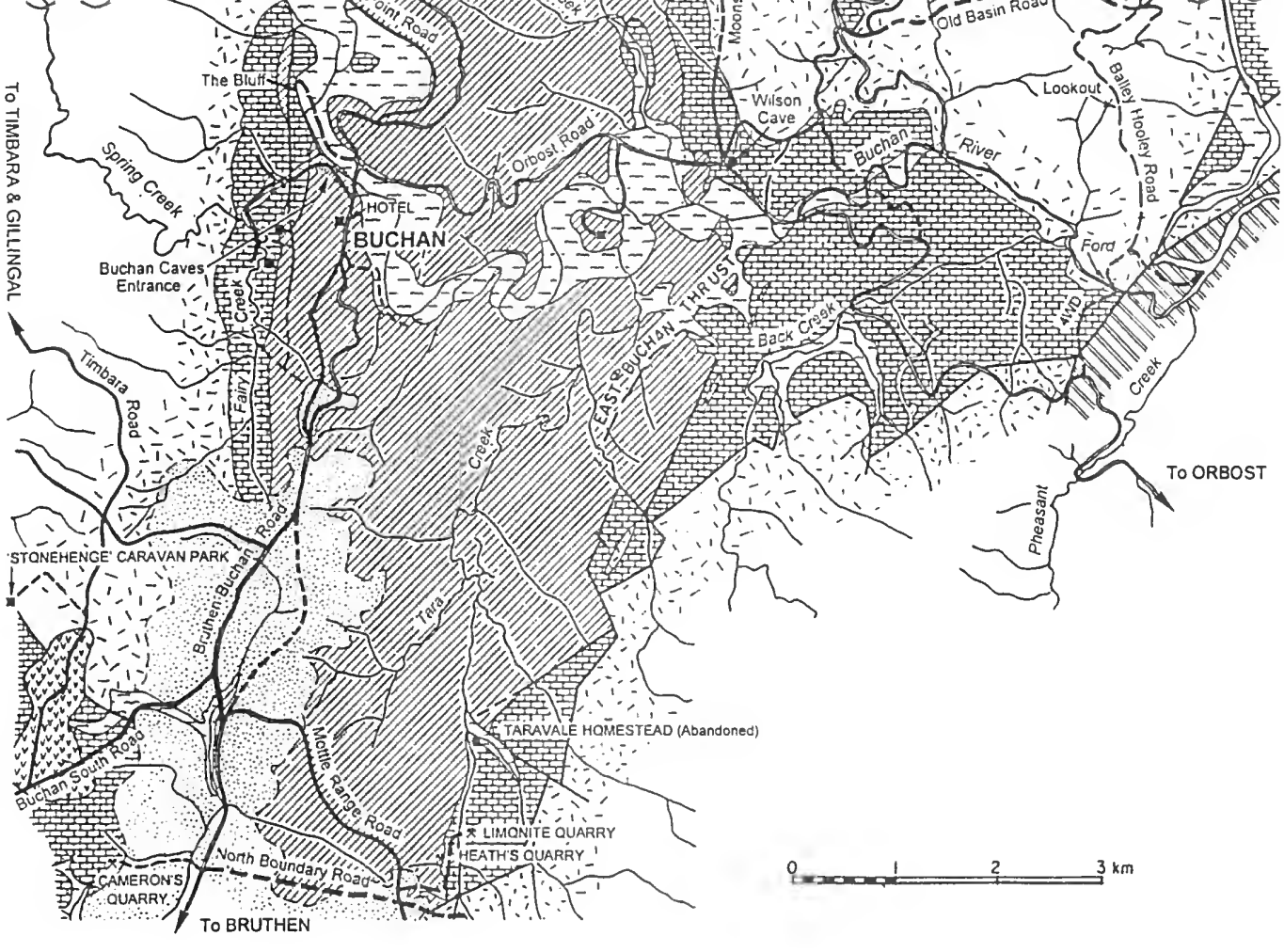

Figure 4. Map of the Buchan-Murrindal area, East Gippsland, showing the extent of Early Devonian Buchan Group formations (adapted from Bell 1996, after Mawson 1987).

Receptaculitids.

Originally considered to be related to the Porifera (sponges), receptaculitids are now generally regarded as algae, possibly a separate order of Thallophytes (Campbell *et al.* 1974). The species *Receptaculites australis* Salter 1859, was first recorded from Buchan by Chapman (1905). It is locally common in the Murrindal Limestone, particularly in the vicinity of Rocky Camp (Fig. 5A), where it occurs as an accessory to other reef-building organisms, namely tabulate corals and stromatoporoids (Teichert & Talent 1958).

Cephalopods

Nautiloids are represented by about 20 species and generally are rather evenly distributed throughout the Buchan Group except in the pure mudstone facies. Unfortunately, like the gastropods, many specimens are too poor for accurate identification (Teichert & Talent 1958) Fig. 3F. Eight genera were recognised by Teichert & Glenister (1952) from the Taravale Formation, *Buchanoceras*, *Pectinoceras*, *Polyelasmoceras*, *Brachydomoceras*, *Macrodomoceras*, *Litogyroceras*, a single specimen of *Sceptrites*, and straight species referred to the genus *Michelinoceras*.

Perhaps the most important cephalopods in the Buchan Group are the **ammonoids** (goniatites), found in the lower part of the Taravale Formation, as they occur in the *dehiscens* (conodont) Zone making them among the oldest firmly dated ammonoids in the world (Mawson 1987). Genera present are *Bactrites*, *Lobobactrites*, *Teicherticeras* (=*Gyroceratites* of Talent 1948) - Fig. 5B & C, *Talenticeras* and *Anarcestes*? (Teichert 1948, Erben 1965).

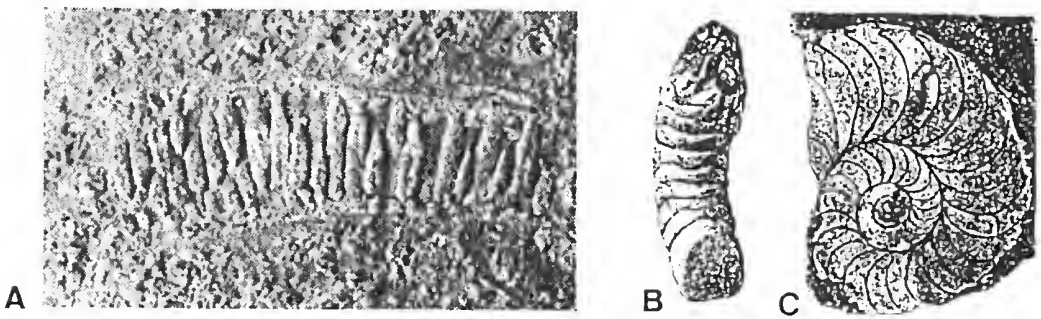

Figure 5. A, weathered section of *Receptaculites australis* Salter 1859 x 1.4, Murrindal Limestone, track to old Rocky Camp Quarry; B, dorsal view and C, longitudinal median section of the ammonoid *Teicherticeras desideratus* (Teichert 1948) x 1, Taravale Formation, Buchan-Gelantipy Road (after Teichert 1948).

Dacryoconarids

Dacryoconarids, small conical shells of pelagic organisms belonging to the class Tentaculitoidea (a group of enigmatic animal remains of uncertain affinities), are common in the Taravale Formation where they are represented by the genus *Nowakia*. They have also been found in the Buchan Caves and Murrindale Limestones.

Bryozoa

Bryozoa are rare and to date no detailed examination of the fauna has been carried out, although Teichert and Talent (1958) note that several species occur in the 'Rocky Camp Member' of the Murrindal Limestone.

Trilobites

Trilobites are rare in the Buchan Caves Limestone and, with the exception of the calcareous facies, in the Taravale Formation. On the other hand the Murrindal Limestone contains a very diverse trilobite fauna, although only species of the styginid trilobites *Scutellum* and *Xyoeax* have been described (Holloway 1996). Other genera represented in the Murrindal Limestone include *Harpes*, *Proetus*, *Myoproetus*, *Cornuproetus*, *Piriproetus*, *Tropidocoryphe*, *Alberticoryphe*?, *Scharyia*, *Cyphaspis*, *Crotalocephalus*, *Gravicalymene*, *Phacops*, *Dudleyaspis*, *Leonaspis*, *Koneprusia*, *Ceratocephala*, *Ceratocephalina*, and *Acanthopyge* (*Lobopygae*) - Holloway pers. comm.

Ostracodes

Ostracodes are very common at several horizons in the upper part of the Buchan Caves Limestone but the fauna has not been fully described. Seven genera have been recorded from this formation and four from the Taravale Formation (Krommelbein 1954, Reynolds 1978). Only *Bairdia* is known to occur in the Murrindal Limestone.

Conodonts

Pioneering work on conodont faunas from the Buchan Group was carried out by Philip (1966). However it was Mawson (1987) who investigated the distribution of polygnathid conodont faunas in the Taravale Formation and used the zonal schemes established in the Northern Hemisphere as the basis for determining the age of the Taravale Formation and its important ammonoid fauna (goniatites and bactritids). The stratigraphic relationship between the Early Devonian

dehiscens to *serotinus* conodont zones and the units of the Buchan Group in the Buchan-Murrindal area are shown on Fig. 2.

Echinoderms

These are only represented by undescribed crinoid columnals.

Fishes

The first record of fossil fishes from the Buchan Group are of placoderm plates described by McCoy (1876). Apart from descriptions of a placoderm skull from Buchan (Chapman 1916), later assigned to a new genus *Buchanosteus* by Stensio (1945), and a dipnoan mandible (Hills 1936), it was not until Long (1984) described three new species of placoderms from the 'McLarty Member' of the Murrindal Limestone that any major work on these vertebrates was published. In addition to the new species of *Murrindalaspis* (2) and *Taemasosteus*, Long also recorded the presence of the placoderms *Wijdeaspis*, *Arenipiscis* and *Errolosteus*, as well as acanthodian and elasmobrach scales and an acanthodian jaw (*Rockycampacanthus* Long 1986).

Brachiopods

Brachiopods are the most prolific group of fossils in the Buchan Group, both as regards their abundance and the number of genera and species represented (Teichert & Talent 1958). Since Talent (1956) listed ten species in five genera, the number of recognised genera alone has risen to at least 17, with others yet to be described. The most common brachiopods to be found are the spiriferidines *Spinella buchanensis* Talent 1956 (Fig. 6A) and *Howittia howitti* (Chapman 1905), the athyridine *Buchanathyris westoni* Talent 1956, and the chonetidine *Protochonetes australis* (McCoy 1876) - Fig. 6B. Although all of these are recorded from the Buchan Caves Limestone, predominantly from the upper beds, only *Howittia howitti* and *Protochonetes australis* appear to occur in all three formations, the latter being plentiful in the mudstones and impure limestone nodules low in the Taravale Formation. Another chonetidine *Septachonetes teicherti* (Gill 1951) is also common in certain horizons high in the Pyramids Member.

Of the three formations, again it is the Murrindal Limestone that has the most diverse fauna, containing over a dozen brachiopod genera. Five of these genera, of which *Malurostrophia flabellicauda* Campbell & Talent 1967 is the most common, are not known to occur in either the Buchan Caves Limestone or the

Taravale Formation. Other genera recorded from the Buchan Group but not previously mentioned, include *Ambocoelia*?, *Quadrithyrina*, *Parachonetes*, *Delejina*, *Coelospira*, *Desquamatia*, *Peetzatrypa*?, *Mesodouvillina*, *Eoschuchertella*, *Eoglossinotoechia*? and *Athyris*.

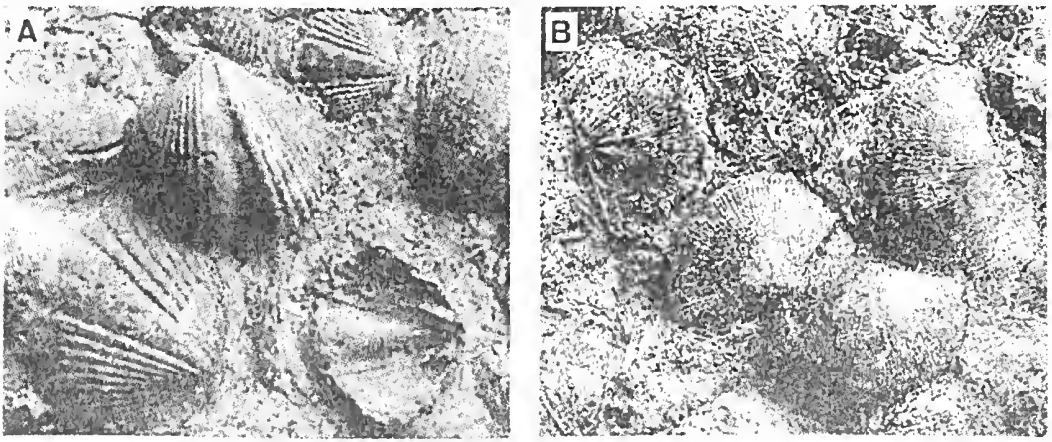

Figure 6. Weathered slabs showing brachiopods: A, *Spinella buchanensis* Talent 1956 x 1.2; B, *Protochonetes australis* (McCoy 1876) x 1.3

PLACES OF SPECIAL PALAEONTOLOGICAL INTEREST

The Basin. Just over 2.5 km NE of Mt McLeod, near the northern arm of Spooner Creek, is an outcrop of the Buchan Caves Limestone, Spring Creek Member, that includes tuffs, mudstones, minor rhyodacite flows and a distinctive red and white fossiliferous band of jasper with manganiferous partings. Within the band, the fossils (mainly brachiopods, gastropods and occasional nautiloids) are replaced with both jasper and chalcedony; the infilling predominantly by chalcedony followed by replacement of matrix with jasper (Bradley 1969). [To visit this area, owner/leaseholder permission required]

Jungle Creek. A few hundred metres east of the Nunnett Road in the Jungle Creek area (approximately 22 km NNW of Buchan), a silicified log several metres long and about 1 metre in diameter was unearthed from basaltic soils in the 1970s during bulldozing for a forestry track. This fossil wood, *Crytocaryoxylon gippslandicum* Leisman 1986, is probably Late Eocene to Early Oligocene in age (about 36.5 my).

The limestone quarries. Limestone was first quarried at Murrindal Park for use in the construction of the Murrindal Homestead between 1860 and 1865. By the

early 1900s the old **Rocky Camp (Commonwealth) Quarry** was a thriving concern. However, operations eventually closed down until 1959 when quarrying was recommenced lower down the hill by Australian Paper Mills, having transferred their operations from South Buchan. The **Rocky Camp** (APM) **Quarry** is still fully operational although now owned by David Mitchell. It produces lime for agricultural and industrial purposes.

The most interesting of the limestone quarries in the Buchan area is **Martin Cameron's Quarry** at South Buchan (Fig. 7). Situated 6.7 km SSW of Buchan township, the quarry (one of two on the property) was opened in the first decade of the 20th century. It is the source of the famous black "Buchan Marble" used in Melbourne for the pillars of the Shrine of Remembrance, the staircase in the State Library and as a facing for numerous other buildings. It was also used in the construction of the Commonwealth Buildings in London. The source of the "marble", a rich fossiliferous thick dark limestone bed dominated by stromatoporoid, tabulate and rugose coral faunas, underlies crystalline limestone consisting of 50% *Thamnopora* colonies. Once thought to be a carbonate buildup in the Taravale Formation, it is now considered to be part of the Buchan Caves Limestone (Fletcher 1963). The quarry ceased operation in 1960. [Private property]

Figure 7. Cameron's Quarry, South Buchan (circa 1980), source of the black "Buchan Marble"; Buchan Caves Limestone.

Also situated to the south of Buchan, but near the headwaters of Tara Creek to the east of the Bruthen-Buchan road, is **Heath's Quarry.** Extraordinarily fossiliferous, it is also considered a buildup in the Buchan Caves Limestone

although it appears to have formed above the top of the formation, possibly continuing to grow after the beginning of the transgressive event expressed by the Taravale Formation (Mawson *et al.* 1992). It consists of undolomitized limestone, generally ranging from pale to mid grey, made up almost entirely of stromatoporoid colonies with less significant contributions of tabulate and rugose corals (Talent 1956). The various coloured limestones from the quarry have been used solely for building facings, monuments and the like. [Private property]

Within the Buchan Caves Limestone, a few hundred metres NE of Heath's Quarry, is a **limonite deposit** quarried during the 1950s and 60s for use in the scrubbing of town gas. The origin of the limonite is considered to represent a gossan developed over a conformable pyrite body (Bowen 1970). The deposit contains limestone fragments in various stages of ferruginization in which it is common to find evidence of fossil structures, usually in the form of moulds.

To the east of Heath's Quarry and the limonite quarry the road leads along the lower slopes of the hills to an outcrop of reddish-pink limestone.

The caves. The Buchan-Murrindal area contains hundreds of recorded potholes, sinkholes and caves, the largest outcrop of caves and karst forming limestone in Eastern Australia, south of Chillagoe, Queensland. Mammalian and avian fossil remains of Quaternary age, dating back to approximately 33,000 yBP, have been found in many of the caves, in particular Cloggs Cave, Mabel Cave and Pyramids Cave (Wakefield 1967, 1972; Baird *et al.* 1991; Baird 1993). The accumulation of bones in these caves, usually the result of predation by owls, are generally the fossil remains of extant species. However, species found in the oldest deposit of the Pyramids Cave have not been recorded living or known from any other fossil deposit within hundreds of kilometres (Wakefield 1972).

Nowa Nowa. Although well to the south of the Early Devonian Limestones and the surrounding Snowy River Volcanics of the Buchan-Murrindal area, numerous outcrops of Middle Miocene Bairnsdale Limestone in the vicinity of Nowa Nowa (26.5 km SSW of Buchan) are of particular interest as they contain interesting echinoid, brachiopod and to a lesser extent molluscan faunas.

The Pyramids. Situated about 7 km NNE of Buchan, three isolated stacks of bedded limestone, separated by deep fissures, top the crest of an extensive limestone outcrop that rises over 100 m above the level of the adjacent Murrindal River (Fig. 8). Known officially as "The Citadel Rocks" but more commonly as "The Pyramids", the outcrop has pronounced karst features and dominates one of the most picturesque and significant environmental areas of the district. Lower

sections of the limestone cliffs at The Pyramids are finely interbedded with mudstones while towards the top the limestone becomes more massive and richly fossiliferous. To the west of the hill, the normal flow of the Murrindal River disappears into a system of subterranean caverns through a rock choked sink hole, to reappear some 800 m to the south near the old Pyramid Mine. In winter and spring, excess water flows around a dry river channel to the north and east of The Pyramids where large pools, potholes, small rapids and a waterfall have been cut in the Snowy River Volcanics adjacent to the contact with the Buchan Caves Limestone. Near the top of The Pyramids, the collapse of an old cavern system has formed a large chasm 10 to 15 m wide with cliffs on each side reaching 20 m in height. [The Pyramids are situated on public land although the surrounding land to the north and west including the access road are private property]

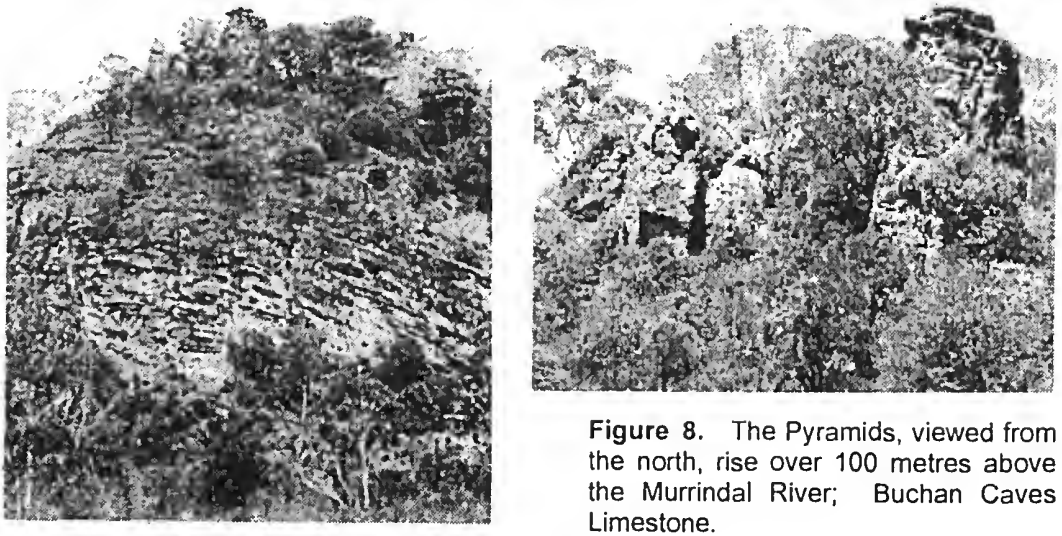

Figure 8. The Pyramids, viewed from the north, rise over 100 metres above the Murrindal River; Buchan Caves Limestone.

FOSSIL PRESERVATION

The very nature of the highly fossiliferous massive and bedded limestones so often found in the Buchan-Murrindal area, make the removal of individual macrofossil specimens from the surrounding matrix extremely difficult (if not impossible) unless the fossils have been replaced by silica - not a common occurrence in this area. Few fossils are found loose other than an occasional brachiopod or solitary coral and, because of the crystalline nature of many of the

limestones, split surfaces rarely reveal useful information without a considerable amount of preparation.

To study these fossils and indeed to appreciate the beauty of the important reef building faunas (corals and stromatoporoids) it is often necessary to cut pieces of matrix with a diamond saw and polish the exposed surface to reveal a fossil's structure (Fig. 3A, B & D-F are all photographs of cut and polished slabs). However, the surface of naturally exposed limestone and impure limestone outcrops are often heavily weathered, often revealing fossils in strong relief (Figs 3C, 6A & B). Small deeply weathered slabs containing high concentrations of brachiopods, usually *Spinella*, are quite common.

Small weathered slabs and cobbles, which can easily be carried, are worth collecting. Attacking large boulders and massive outcrops with a crack hammer, apart from being extremely dangerous, will more than likely damage any fossils retrieved - far better carry a camera with a close-up lens (and a small brush to dust flat surfaces) and leave the outcrop for others to enjoy. The photograph on the front cover was taken in-situ - part of a flat outcrop extending several metres along the top of a hill.

Please note that digging, hammering and/or removal of rocks or fossils from the Buchan Caves Reserve, managed by Parks Victoria, is not permitted.

GENERAL TOURIST INFORMATION

Buchan Township: Post Office, Police Station, Bush Nursing Centre, General Store, Hotel, Buchan Motel (03 51559201), Garage, Cafe, Take away food shop (+ petrol), Black Marble Hut (artifacts & souvenirs).
Buchan Caves Reserve (03 51559264): Caravan Park, kiosk, toilets, bbq & picnic facilities, guided tours of the Fairy Cave and Royal Cave (Parks Victoria).
Stonehenge Rockhounds Caravan and Camping Park (03 51559312): Situated on a farm at Buchan South - museum on property (Privately owned).
For further information contact Tourism Victoria, Lakes & Wilderness Tourist Office on 1800 637 060 or visit the website www.visitvictoria.com.au

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Tom Darragh & David Holloway (Museum Victoria) and Ian & Judy Grey (Buchan P.O.) are thanked for their advice and assistance in tracing references. Ken Bell (Inverleigh) is also thanked for his helpful comments on the manuscript. Tony Holmes assisted with photographic reproductions.

References

Major sources of historical information

Buchan Sesquicentenary Committee, 1989. *Bukan-Mungie: 150 years of settlement in the Buchan District (Victoria) - 1839-1989*, 13Opp.
O'Bryan, D., 1983. *Pioneering East Gippsland*, 61pp.
Walker, M. H., 1971. *Come Wind, Come Weather: a biography of Alfred Howitt.* Melbourne University Press, 348pp.

Major sources of geological information

McRae-Williams, M. S., Rosengren, N. J. and Kraemers, S. M., 1981. Sites of geological and geomorphological significance in East Gippsland, Victoria. *Ministry for Conservation, Victoria, Environmental Studies Division Publication* 320: vi + 641pp. & map.
Teichert, C. and Talent, J. A., 1958. Geology of the Buchan area, East Gippsland. *Geological Survey of Victoria, Memoir* 21: 56pp. + map.
VandenBerg, A. H. M., 1988. Silurian - Middle Devonian. Pp. 103-146 in *Geology of Victoria.* J. G. Douglas and J. A. Ferguson (eds), Victorian Division, Geological Society of Australia Incorporated, Melbourne.

Topographical maps (VICMAP - Survey & Mapping Victoria)

1:50,000 topographical map 8523S Murrindal - Yalmy
1:25,000 topographical map 8522-4-1 Mount Tara
1:25,000 topographical map 8522-1-4 Lucas Point

Palaeontology & Geology (abridged)

Baird, R. F., 1993. *Alcheringa* 17: 383-404.
Baird, R. F. *et al.*, 1991. *Vert. Palaeo. of Australasia*, 850-871.
Bell, K. N., 1996. *Proc. Roy. Soc. Vict.* 108(2): 73-106.
Benson, W. N., 1922. *Rec. Geol. Surv. N.S.W.* 10(2): 83-204.
Bowen, K. G., 1970. *Min. & Geol. Jour.* (Vict.) 6(6): 71-79.
Bradley, K., 1969. *Proc. Roy. Soc. Vict.* 82: 277-285.
Campbell, K. S. W. & Talent, J. A., 1967. *Proc. Roy. Soc. Vict.* 80: 309-329.
Campbell, K. S. W. *et al.*, 1974. *Palaeontographica* 146: 52-77.
Chapman, F., 1905. *Proc. Roy. Soc. Vict.* 18(I): 5-15.
1912. *Rec. Geol. Surv. Vict.* 3(2): 218-222.
1914. *Australasian Fossils.* 341p.
1916. *Proc. Roy. Soc. Vict.* 28(2): 211-215.

References cont.

Erben, H. K., 1964. *Neues Jb. Geol. Palaont. Abh.* 120: *107-212.*
1965. *Neues Jb. Geol. Palaont. Abh.* 122: 275-312.
Ferguson, W.H., 1898. *Geol. Surv. Vict. Prog. Rep.* 9: 99-100.
Fletcher, K., 1963. *Proc. Roy. Soc. Vict.* 76: 169-179.
Gill, E. D., 1951. *Proc. Roy. Soc. Vict.* 63: 57-72.
Hill, D., 1940. *Proc. Roy. Soc. N.S.W.* 74: 247-276.
1950. *Proc. Roy. Soc. Vict.* 62: 137~164.
Hills, E. S., 1936. *Geol. Mag.* 73: 213-226.
Holloway, D. J., 1996. *J. Paleont.* 70(3): 428-438.
Howitt, A.W., 1876. *Geol. Surv. Vict., Rep. Prog.* 3: 181-249.
Johnston, P.A., 1993. *A.A.P. Memoir* 14: 1-134.
Jones, 0. A., 1937. *Rec. Aust. Mus.* 20:79-102.
Kroemmelbein, K., 1954. *Senckenbergiana lethaea* 35: 193-229.
Leisman, G. A., 1986. *Alcheringa* 10: 225-234.
Long, J. A., 1984. *Proc. Roy. Soc. Vict.* 96: 173-186.
1986. *Zool. J. Linn. Soc. London* 87: 321-339.
McCoy, F., 1876. *Prod. Palaeo. Vict.*, Dec. 4: 32pp.
Mawson, R., 1987. *Palaeontology* 30(2): 251-297.
Mawson, R. *et al.*, 1992. *Proc. Roy. Soc. Vict.* 104: 23-56.
Murray, R. A. F., 1895. *Geology and Physical Geography.* Melbourne, iv + 150p
Philip, G. M., 1966. *Micropalaeontology* 12: 441-460.
Reynolds, L., 1978. *Palaeontographica Abteilung* A 162: 144-203.
Ripper, E. A., 1937. *Proc. Roy. Soc. Vict.* 50: 1-9.
Selwyn, A. R. C. & Ulrich, G. H. F., 1867. *Intercol. Exhib. Essays, 1866-67*, No. 3. Melbourne, 147-235.
Stenzio, E. A., 1945. *Kung. svenska VertenskapAkad. Handl.* (3), 22: 1-70.
Stirling, J., 1889. *Rep. Mining Regist. Quar. ended 31st Dec.* 1889: 65-68
Strusz D. L. *et al.*, 1972. *J. Geol. Soc. Aust.* 18: 427-455.
Talent, J. A., 1956. *Proc. Roy. Soc. Vict.* 68: 1-56.
Teichert, C., 1948. *J. Paleont.* 22(1): 60-67.
Teichert, C. & Glenister, B. F., 1952. *J. Paleont.* 26: 730-752.
Teichert, C. & Talent, J. A., 1958. *Geol. Surv. Vict., Mem.* 21: 56pp. + map.
Wakefield, N. A., 1967. *Vict. Nat.* 84: 211-214.
1972. *Proc. Roy. Soc. Vict.* 85: 1-26.
Webby, B. D. *et al.*, 1993. *Proc. Roy. Soc. Vict.* 105(2): 113-185.
Whitelaw, 0. A. L., 1899. *Geol. Surv. Vic., Mon. Prog. Rep.* 2: 16-22.

BOOKS AND BOOK REVIEWS

DINOSAURS OF DARKNESS by Thomas H. Rich and Patricia Vickers-Rich. Allen & Unwin, Crows Nest, N.S.W., 2001 (softback), 222pp. ISBN 1865084964. Recommended retail price AU$39.95 (including G.S.T.).

In recent years, through the press, we have gleaned tantalizing glimpses of dinosaur bones being recovered from Dinosaur Cove on Victoria's southern coastline.

In writing *Dinosaurs of Darkness,* the author's share with readers the processes involved in the discovery and recovery of these vertebrate fossils from fluvial deposits on the coastal edge of the Otway and Strzelecki Ranges.

The project started with a vision of finding fossils of Cretaceous mammals and birds, a goal that was ultimately achieved. Along the way, a treasure trove of dinosaur bones, predominately from *Hypsilophodonts,* was recovered from ancient stream channels preserved in the Cretaceous sandstones.

Tunnelling into the base of 90 m high cliff faces to follow these stream channels, while dodging rogue waves from the Great Southern Ocean, was a severe logistic and physical challenge to both researchers and their willing band of volunteers.

The authors present aspects of the climatology of southern Australia during the reign of these dinosaurs and rare mammals. A strong case is made for a near polar existence with very low temperatures and long periods of darkness in winter. Comparison is presented with similar ecosystems in the northern hemisphere.

This book also serves to highlight the great spirit of cooperation that can occur between research scientists, volunteers and commercial enterprises that logistically and financially support such pioneering research.

In short, I found *Dinosaurs of Darkness* a very interesting read which to me had only two detracting features:

(1) The Inclusion of imperial units bracketed after metric units, eg. 200 L (55 gallons). This use of American units appears to be a hangover from the first edition being printed in the U.S.A and could be confusing to Australian readers not familiar with U.S. measures.

(2) In Chapter 13, the authors address such issues as professional salaries and paid childcare during field research. Whilst these may be important issues about which there will be widely varying views, I felt that inclusion here was strongly out of context with the remainder of the book.

Dinosaurs of Darkness should have wide reader appeal including those interested in the earth sciences and palaeontology. It should be interesting background reading for those contemplating a large research project with the usual minimal funding.

Am I happy to have this volume on my bookshelf? The answer, undoubtedly yes!

Reviewed by Ian Sobbe

IN THE NEWS

Paleontologists Debate *T. rex's* Nature as Predator or Scavenger.

Here's tough news for *Tyrannosaurus rex*, long hailed as the most terrifying creature to ever walk the Earth. An emerging theory holds that *T. rex* was no tyrant lizard king (this is what *Tyrannosaurus rex* means) at all. Instead of a vicious killer, it may have been a scavenger - "essentially a gigantic vulture," to quote one of the dinosaur enthusiasts who discuss such things on the Internet.

It's not a view warmly embraced by *T. rex's* greatest fans. "Sixth graders hate it," acknowledged Jack Horner, the lading advocate of the hypothesis. Horner is a paleontologist at Montana State University, a major centre for the study of dinosaur fossils. Horner has become chief prosecutor in the trial of one of the most enduring preconceptions about the world's most popular dinosaur. The belief the *T. rex* was a fleet, savage hunter - imprinted on the current generation by scenes from Jurassic Park and Lost Worlds - has been widely held not just by the public but by paleontologists too.

"I don't think we have any evidence that *T. rex* was a hunter, he's got all the attributes of a scavenger," said Horner. Take the stubby, vestigial arms that have only two small claws. The arms were so short that *T. rex* couldn't even touch them together, known dinosaur predators such as *Velociraptor* and *Deinonychus* had long powerful arms and big claws for grabbing prey on the run, Horner said.

"*T.rex* had a huge olfactory lobe on the brain" needed to smell carrion from a great distance, "very similar to a turkey vulture's," Horner said. "*T. rex* also had a small optic lobe and very small eyes" for its size, when compared to the relatively

large eyes for the known killer dinosaurs, he said.

"Other predators like *Velociraptor* had knife like, flat teeth for ripping flesh, while *T. rex* had huge powerful jaws and rounded bone crushing teeth, if you're the first one to a carcass, you don't need to crush bones," said Horner.

Horner also argues that *T. rex's* huge hind legs and nearly seven ton body were built for walking, not for speed, despite what Jurassic Park portrayed. "So *T. rex* let other carnivores do the dangerous work of killing, and then moved in for the feast. All you have to be is big and ugly to chase the others away," said Horner.

Horner's colleagues are not convinced, they say *T. rex* was capable of hunting and probably did a bit of scavenging too. "*T. rex* probably hunted or scavenged depending on the season and on its youth and agility. Relying solely on dead meat to nourish such a large body would have been a risky way to live," said Thomas Holtz Jr., a University of Maryland paleontologist and one of about eight *T. rex* specialists in the world. Holtz and other dinosaur experts also take issue with Horner's other evidence.

Consider those scrawny arms. "Snakes and birds don't use arms to trap prey," said Professor Kevin Padian, curator of the Museum of Paleontology at the University of California, Berkeley. "As for the big olfactory lobe, a good sense of smell can be just as important to a predator as a scavenger, and many predators have small eyes," said Padian. Padian also added that the shape of the teeth are not definitive evidence either. Different types of hyenas, for example, all have the same type of teeth but are divided among those that are primarily predators and those that rely more on scavenging, Padian said.

Yet Horner's crusade has made experts more careful about jumping to conclusions, Holtz acknowledged. Although the scavenger suggestion first arose more than eighty years ago, most dinosaur scientists in modern times were unlikely to doubt that *T. rex* was primarily a hunter, at least before Horner came along, Holtz said. "I think Horner has put the air of caution in there, which is good. It is fairer and more accurate to put our question marks in there," Holtz said.

Horner seems to enjoy rattling the bones of *T. rex* orthodoxy. He said the main reason for dramatizing his scavenger theory is not to try to prove what probably can't be proved one way or another but "for the public to see how science works." A provocative hypothesis stirs a greater reaction, and the ensuing debate sheds more light on the problem, he said. Padian agrees, "It's good for the public as it gives them an idea of how we think."

Summary of story in the *San Francisco Chronicle*, February 5, 2001.